



January 14, 2015

Attention: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Re: Strata Energy, Inc., Ross In Situ Recovery Project
Source Materials License SUA-1601, Docket No. 040-09091
Annual Revised Bond Estimate

To Whom it May Concern:

By letter dated July 16, 2014, Strata Energy Inc. (Strata) submitted an initial estimate for the costs to decommission the Ross ISR project. This submittal was made as required by License Condition 9.5. To date Strata has not received approval of the estimate or a request for additional information from NRC. By this letter Strata requests that NRC cease review of the July 2014 surety estimate and review and approve the attached annual revised bond estimate. This annual update is required by Strata's Permit to Mine issued by the Wyoming Department of Environmental Quality (WDEQ) Land Quality Division (LQD).

Enclosed are the surety estimate and a revised Restoration Action Plan (RAP). This estimate covers the projected costs for decommissioning and reclamation of facilities planned for construction and operation during 2015. In summary, the surety estimate includes the estimated costs for a third party to decommission and complete final reclamation of the first four (4) wellfield modules at Mine Unit 1 (MU-1), the Central Processing Plant (CPP), water storage ponds and all other related facilities anticipated to be constructed during the first year. The estimate also includes the costs to complete final reclamation for well installation activities in MU-1 and a limited portion of MU-2 and the plugging of all wells.

The attached estimate puts the costs of groundwater restoration, decommissioning and reclamation at \$5,757,600 over a three year period during which the site would be decommissioned and reclaimed to meet the standards of the WDEQ LQD and the NRC. The estimate format implements the recommended format provided by the LQD.

The RAP encompasses the full cycle of activities necessary for:

- Aquifer restoration and well plugging;
- Building and equipment decontamination, dismantling and disposal;
- Pond and wellfield removal and reclamation of the entire site;
- Radiological surveying and environmental monitoring;
- Project management and miscellaneous costs; and
- Contingency of 25%.

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Strata hereby requests that NRC approve the estimated bond amount and amend License SUA-1601. Strata respectfully requests that NRC review and approve this estimate in a timely manner as the current bond amount will limit well installation activities in the near future.

If you have any questions regarding the provided information, please contact me at 307-686-4066 or by email at mgriffin@stratawyo.com.

Sincerely,
STRATA ENERGY INC.

A handwritten signature in black ink, appearing to read "Mike Griffin", is written over the printed name and title.

Mike Griffin
Vice President of Permitting, Regulatory and Environmental Compliance

Cc: John Saxton, NRC Project Manager (via email)



Attachment 1
Revised Restoration Action Plan

RESTORATION ACTION PLAN

A. INTRODUCTION

The following summarizes the Restoration Action Plan (RAP) for the first year of development and operation of the Ross ISR Project (calendar year 2015). The accompanying surety estimate is based on this RAP and it covers the potential decommissioning and reclamation of facilities planned for construction and operation during the period. In summary, the surety estimate includes the estimated costs by a third party to decommission and complete final reclamation of the first four (4) wellfield modules at Mine Unit 1 (MU-1), the Central Processing Plant (CPP), water storage ponds and all other related facilities anticipated to be constructed during the first year. The estimate also includes the costs to complete final reclamation for limited well installation activities in a portion of MU-2 and the plugging of all wells.

The estimate puts the costs of groundwater restoration, decommissioning and reclamation at \$5,757,600 over a three year period during which the site would be decommissioned and reclaimed to a condition agreed upon by the Wyoming Department of Environmental Quality (WDEQ) Land Quality Division (LQD) and the US Nuclear Regulatory Commission (NRC) that would return the site to unrestricted use. The RAP encompasses the full cycle of activities necessary for:

- Aquifer restoration and well plugging;
- Building and equipment decontamination, dismantling and disposal;
- Pond and wellfield removal and reclamation of the entire site;
- Radiological surveying and environmental monitoring;
- Project management and miscellaneous costs; and
- Contingency of 25%.

Strata's surety estimate presented herein employs assumptions that are based on best professional judgment given the data currently available. This

estimate is presented in the Excel format specified by the WDEQ-LQD. Although this format is different than that originally submitted with the Permit to Mine/NRC License applications the major components of the estimate are the same. This surety estimate is less than that originally submitted (\$9,822,600) due to the following major changes over the plans for facility construction and operation and some revisions to the RAP:

- Yellowcake processing and drying will not be done at the CPP during the first year. The CPP will only be used as a “Satellite” IX facility with loaded IX resin shipped to another licensed facility for toll processing. Uranium elution, precipitation and drying equipment will not be installed. Therefore, there is considerably less equipment that will require decontamination and disposal as 11e.(2) waste or non-contaminated solid waste.
- The size of the CPP is reduced such that it initially will only house IX type equipment. Uranium elution, precipitation and drying equipment will not be installed. This substantially lessens the surety estimate costs for building decontamination, decommissioning, and demolition costs.
- The operation of the facility as a Satellite eliminates the need for a chemical storage building and separate warehouse/maintenance building. This lessens the costs for building demolition and disposal.
- Two deep disposal wells (DDW) may be installed instead of three. This lessens the cost of final abandonment and reclamation of one deep disposal well.
- Only one waste water pond (Pond 1 with 3 cells) will be initially constructed. This reduces the costs for decontamination, decommissioning and disposal of the pond liner and associated reclamation work.

- The original surety estimate included the costs to transport and dispose of all non 11e.(2) building material (steel, concrete, wood) from demolition activities at the Moorcroft Municipal Landfill which is located 23 miles from the site. Due to the fact that Strata owns the land at the CPP site and the WDEQ Solid and Hazardous Waste Division (SHWD,) as well the local municipalities, do not desire that these types of waste be disposed at municipal landfills, these materials will be disposed on site via burial. Accordingly, the costs for on-site disposal have been included in accordance with WDEQ/LQD Guideline 12. This change substantially reduces the disposal costs for building materials as the costs to transport the waste 23 miles and the dumping fees at the Moorcroft Municipal Landfill (approximately \$57/ton) are eliminated. All other non-construction related solid waste (e.g., trash) will be disposed at the Moorcroft Municipal Landfill.

The surety estimate is considered conservative as although no salvage value is considered, significant salvage value would exist for the CPP and Office buildings, motors and electrical switch gear, gravel road base, etc.

B. CONSOLIDATION OF STATE AND NRC SURETY INSTRUMENTS

In addition to being crafted to comply with NRC criteria in 10 CFR Part 40, Appendix A, Criterion 9 (Financial Criteria), Strata's proposed surety estimate is designed to address the Wyoming Environmental Quality Act requirements for a reclamation performance bond. The surety estimate is provided in the format specified by the WDEQ-LQD and accepted by NRC staff.

C. COST DETAILS FOR GROUNDWATER RESTORATION, RECLAMATION, AND DECOMMISSIONING ACTIVITIES

1. Introduction

The following tabulation summarizes the costs necessary to hire an independent contractor to assume all groundwater restoration, decommissioning and reclamation activities required for the CPP (only IX system), the first four (4) wellfield modules, and associated facilities. Descriptions of the work are provided below, and detailed costs estimates for each major item of work are provided in the attached Excel spreadsheet entitled Ross 2015 Bond Estimate.

<u>Item</u>	<u>Cost</u>
Groundwater Restoration Cost	\$ 2,931,998
Equipment Removal and Disposal Cost	\$ 76,667
Building Demolition and Disposal Cost	\$ 386,374
Wellfield Building, Pipe and Equipment Removal and Disposal Cost	\$ 240,559
Well Abandonment Cost	\$ 662,265
Wellfield Surface Reclamation Cost	\$ 42,390
Total Miscellaneous Reclamation Cost	<u>\$ 265,849</u>
Subtotal	\$ 4,606,102
Administrative, Overhead and Contingency (25%)	<u>\$ 1,151,525</u>
Total (Calculated in 2014 Dollars)	\$ 5,757,600

2. Aquifer Restoration

2.1. Introduction

The Groundwater Restoration worksheet (GW REST) and supporting unit cost worksheets (UC-GWS, UC-RO, UC-RECIRC, and UC-WDW) contain details concerning cost basis figures and assumptions, calculations and methodologies used in deriving cost estimates for the full cycle of groundwater restoration. It is assumed that active restoration will be completed in 15 months and that an additional 12 months will be necessary for final site decommissioning and reclamation following the stabilization monitoring period and regulatory

approval of groundwater restoration. This estimate is designed to be descriptive enough for the NRC and WDEQ staff to determine the acceptability of Strata's proposed cost figures and is based on the estimated costs for an independent contractor to perform the decommissioning and reclamation work in accordance with 10 CFR Part 40, Appendix A, Criterion 9 and the Wyoming Environmental Quality Act and its accompanying rules and regulations and guidelines. Strata has developed its cost estimates to address all items in Appendix C of the NRC's "Standard Review Plan for In Situ Leach Uranium Extraction License Applications" (NUREG-1569, dated June 2003).

Among other items, the groundwater restoration costs are broken down into separate phases of work:

Groundwater sweep;
Reverse osmosis (RO) with permeate injection;
Groundwater recirculation;
Monitoring; and
Vehicles and Labor

For each phase of work, the estimated number of pore volume displacements (PVDs) required to complete that phase is provided (0.5 PVD for Groundwater Sweep, 7 PVD for Reverse Osmosis and 1 PVD for Recirculation). The worksheets also provide the assumptions and unit prices for all the work necessary to complete each phase of work for the first four wellfield modules.

Restoration progress is typically measured on the basis of the number of pore volumes (PVs) processed during each phase of groundwater restoration. A pore volume is a term used by the ISR industry to define an indirect measurement of a unit volume of aquifer affected by ISR recovery or restoration (NUREG-1910, NRC 2009). Following industry standards, Strata calculates a PV as follows:

PV = thickness x wellfield area x porosity x flare x conversion factor

The **thickness** is the average completion thickness for the recovery and injection wells. Based on exploration and delineation drilling, the ore zone

thickness averages approximately 8 feet across the area of the first 4 modules in Mine Unit 1.

The **wellfield area** is the surficial area of the injection and recovery well patterns for each wellfield module. Based on the delineation of recoverable resources within Mine Unit 1 (MU-1) the average area per wellfield module is estimated to be 390,011 square feet. Therefore, the total area of injection and recovery well patterns for the first 4 modules that would be potentially injected into during the surety period is approximately 1,560,044 square feet.

The **porosity** or pore space is defined as the collective open spaces of the formation or a measure of the amount of liquid or gas that may be absorbed or produced by a particular formation (NUREG-1910). The porosity of the ore zone within the Ross project area was determined by laboratory analysis of core samples collected during exploration drilling. The porosity is estimated to average 34% across the Ross Project area.

The **flare** is a proportionality factor that estimates the amount of aquifer water outside of the pore volume that has been affected by lixiviant flow during the recovery phase (NUREG-1910). Flare estimates usually include a horizontal and vertical flare factor. The horizontal flare is the volume of water affected by lixiviant outside the edge of the wellfield pattern. The vertical flare is the volume of water affected by lixiviant above and below the completion interval. Based on groundwater modeling of expected operational conditions completed by WWC Engineering to support the permit and license applications for the Ross Project it was determined that the horizontal flare would be approximately 32% and the vertical flare would be approximately 20%. Therefore, the overall flare, which is dependent on the geometry of the affected area, is approximately 58%. This is consistent with other ISR operating facilities.

An estimate of the PV of the four (4) Modules in MU-1 is calculated as follows:

$$PV = 8.0 \text{ ft.} \times 1,560,044 \text{ ft}^2 \times 0.34 \times 1.58 \times 7.48 \text{ gal/ft}^3 = 50.15 \text{ million gallons}$$

Where:

Porosity = 0.34 (dimensionless)

Flare Factor (overall) = 1.58 (dimensionless)

The aquifer restoration phase was based on the processing and circulation of 9.5 pore volumes of groundwater. Because the cost for restoration equipment such as wellfield pumps, lined retention ponds, the deep disposal well, one RO unit, restoration IX columns, laboratory equipment, trucks, and field equipment will have been incurred for uranium production operations, they are considered operational capital and are not included as capital requirements in any of the RAP budget items. It should be noted that the estimated cost of purchasing and installing an additional high efficiency RO unit (\$750,000) is included in the groundwater restoration cost estimate (worksheet GW REST, item VI). This additional RO would be used to augment the RO included with the construction and initial operation of the CPP. As with other operating ISR operations, the NRC and the WDEQ will be able to verify the availability of the restoration equipment during routine inspections.

The surety will be maintained at this calculated level until the number of pore volumes required to satisfactorily complete each phase has been demonstrated. Strata will adjust the surety estimate for aquifer restoration during each annual update review to reflect experience gained from actual work completed and the associated costs.

2.2 Description of Work

The first stage of aquifer restoration is groundwater sweep, in which groundwater is pumped from the wellfield module with no reinjection. This causes water from the formation surrounding the wellfield module to sweep through the wellfield toward the recovery wells and remove the high TDS production fluids. Based on the anticipated aquifer restoration schedule, during most aquifer restoration normal operations, when some wellfield modules are undergoing groundwater sweep while others are in RO treatment

with permeate injection, the water removed from the groundwater sweep is taken to the RO units (see below) and the purified water (RO permeate) is reinjected into the wellfield module(s) undergoing RO treatment with permeate injection. The brine from the RO units is taken to the lined retention ponds and then to a deep disposal well. For the first wellfield module undergoing groundwater sweep, it is assumed there are no wells concurrently in RO treatment with permeate injection. Thus, the groundwater from the groundwater sweep will be taken to the RO units, the high-quality permeate will be discharged or used for other purposes and the brine will be disposed via the deep disposal well. It is estimated that the groundwater sweep will remove about 0.5 PV from the wellfield at a rate of 200 gpm (20 gpm at 10 wells) per module. The duration of the groundwater sweep will be about one month per module. Groundwater sweep at one module may be done concurrently with RO at another module.

RO is a water treatment process whereby the majority of dissolved ions, which are too large to pass through a filter that passes pure water molecules, are concentrated into brine. The product water that passes through the filter (permeate) typically meets drinking water standards and during most restoration activities is reinjected back into the wellfield. This reinjection of relatively pure water permeate mixes with formation water and helps bring the quality of the underground solutions toward baseline quality. During restoration the RO brine is pumped to a lined retention pond to level out flow rates and is then pumped to the disposal well. Groundwater recovered from a depleted portion of the ore zone will be treated with an antiscalant and/or corrosion inhibitor to prevent fouling; these are the only pretreatment chemicals budgeted. The water will also pass through a restoration IX system for removal of uranium and a pre-filtration system for particulate removal. To achieve RO purification, the pretreated solution is pressurized and directed to the first step of a two-stage RO process. Approximately 70 percent of the total feed volume will be converted to product water (permeate) in the first stage. The

brine water of the first stage will then act as the feed for the second stage, which yields an overall permeate recovery rate of approximately 90 percent. The RO equipment provided for in the capital budget discussed above is sized to operate at a nominal capacity of 700 gpm when combined with the RO system that will be installed for uranium recovery operations. This is sufficient to treat one module in the RO treatment phase and one to three modules in the groundwater sweep phase. It is estimated that RO treatment for Module 1 will require four months due to concurrent groundwater sweep operations. RO treatment for Modules 2 through 4 will require three months each, resulting in a combined RO treatment period of 13 months.

The third phase of aquifer restoration is groundwater recirculation, which begins after completion of the RO treatment with permeate injection phase. In this phase, water from the production zone will be pumped from recovery wells and recirculated into injection wells in the same module. This recirculation will homogenize the groundwater and help reduce the risk of “hot spots,” or areas of unusually high concentrations of dissolved constituents. The only treatment that will potentially occur during recirculation will be the filtration of particulates and/or uranium removal. It is expected that one PV will be circulated from, or within, the wellfield during this phase, at a rate of 500 to 800 gpm per module. This recirculation can be completed concurrently during the overall RO phase once RO is completed at a particular module. The total duration of active aquifer restoration (groundwater sweep, RO treatment with permeate injection, and groundwater recirculation) is estimated to be 15 months for the first four wellfield modules. Labor and operations costs have been included for 24 months to provide a conservative cost estimate for groundwater restoration.

During maximum uranium production operations and the operation of precipitation and yellowcake drying circuits there may be up to five deep disposal wells at the Ross ISR Project used for disposal of brine and any other waste water that does not meet criteria for discharge or other uses. Only one

deep disposal well is planned to be installed during the first year of licensed activities as the volume of wastewater is substantially reduced without yellowcake precipitation and drying circuits. The capital costs of the well will have been borne by Strata during construction of the plant facilities. The cost to plug and abandon this well are included. Additionally, Strata has included the costs to plug and abandon an additional deep disposal well in the unlikely case that a second well needed to be installed due to poor performance of the original well upon completion and testing. The lined retention ponds will be used to store the water until it is ready for deep well disposal. Ponds will have excess capacity to handle variations in water production.

The final step in aquifer restoration will be the stability monitoring phase, which will be used to ensure that chemical species of concern do not increase in concentration to unacceptable levels subsequent to restoration. The stability monitoring phase is described in Section 1.2.1.5 of the WDEQ Reclamation Plan (Section 6.1.2.5 of the NRC Technical Report) and includes well sampling, data analysis and reporting.

2.3 Labor Staffing Plan for Groundwater Restoration

The majority of labor costs for decommissioning the Ross Project would be associated with groundwater restoration. This would include the operation of the wellfield production and injection wells and the CPP and ancillary facilities to complete the groundwater restoration commitments in accordance with the WDEQ permit and NRC license. Therefore, the bulk of the labor requirement is for the initial 15 month period when active groundwater restoration is occurring. Strata has conservatively included 24 months of labor to cover this period.

The stability period requires one year of sample collection and an indeterminate period for regulatory approval of groundwater restoration. During this period the manpower requirements lessen significantly as activities at the site are limited to groundwater monitoring and maintenance of the CPP.

Once the stability period is completed the actual facility decommissioning, demolition and disposal occurs. The associated labor costs are included in the surety estimate details for the particular activity. The labor estimate also included 12 months of Environmental Manager/RSO and Environmental Technician for this period.

Given the above, Strata has included the labor costs associated with groundwater restoration in section IX of the groundwater restoration worksheet (GW REST):

<u>Position</u>	<u>Years</u>
Environmental Manager/RSO	3
Restoration Manager	2
Environmental Technician	3
Operators/Laborers (4)	2
Maintenance Technician	2.5

3. Facilities Area Decommissioning and Reclamation

Following wellfield restoration and stability monitoring, when the water treatment equipment is no longer needed, reclamation can begin on the surface facilities. Procedures are fully described in Sections 6.2 and 6.3 of the Technical Report. Detailed cost estimates for the facilities area decommissioning and reclamation are provided in the following worksheets and supporting unit costs worksheets:

CPP Equipment - EQUIP

Main Facility Buildings- BLDGS

Wellfield Buildings and Pipelines- WF BLDGS PIPE

Well Abandonment- WELL ABAN

Wellfield Reclamation- WF REC

3.1 *Equipment and Buildings*

Unlike the original RAP and surety estimate that included the decommissioning, demolition and disposal of a full scale CPP including yellowcake precipitation and drying equipment, the revised Operations Plan results in the CPP that will only be used as a "Satellite" IX facility. Therefore, uranium elution, precipitation and drying equipment will not be installed. This results in considerably less equipment that will require decontamination and disposal as 11e.(2) waste or solid waste. Additionally, the lack of yellowcake processing will make it easier to decontaminate limited portions of the CPP walls and floor. Buildings to be removed include the CPP, Administration building, the Deep Disposal Well (DDW) building, the Potable Water building and the wellfield module buildings. Decontamination of salvageable building materials, equipment, pipe, and other materials to be released for unrestricted use will be accomplished by completing a preliminary radiological survey to determine the location and extent of the contamination and to identify any hazards. Processing and water treatment equipment, including tanks, filters, IX columns, pipes, and pumps, will be decontaminated as necessary and disposed of in accordance with applicable regulations. Decontaminated and non-contaminated equipment and materials will be disposed at an on-site permitted solid waste facility. Contaminated equipment and materials will be disposed at a licensed 11e.(2) byproduct disposal facility. Building structural materials, concrete flooring, foundations, and foundation materials will be decontaminated, as necessary, broken up, and disposed of at an on-site permitted solid waste facility.

The disposal of non 11e.(2) materials, especially the high volume building steel and concrete at an on-site permitted solid waste facility is desired by both the State of Wyoming (WDEQ) and Crook County and other municipalities due

to the limited space for such material in local municipal landfills. This is appropriate due to the benign character of these wastes and safety concerns with transporting this material via large trucks on rural and single lane roadways. Additionally, Strata owns the land at the CPP site and adequate areas exist to bury the materials in an on-site permitted solid waste facility.

3.2 Ponds

Work required to reclaim the ponds will include brine disposal in the deep disposal well, removal of the liner and brine residue to a licensed 11.e(2) disposal site, disposal of all non-11.e(2) solid waste to an approved landfill or on-site solid waste facility, backfilling and regrading to restore an acceptable topography, topsoil replacement and revegetation. These reclamation costs are provided in the worksheet MISC REC.

3.2 Earthwork

After the buildings and ponds are demolished and removed, the entire site will be regraded to restore the original topography, topsoil will be replaced to approximate its original depth, and the area will be seeded with the approved seed mix. Earthwork costs to complete the regrading of the CPP, parking areas, and access roads are provided in the worksheet MISC REC.

3.3 Containment Barrier Wall

The containment barrier wall (CBW) at the CPP will be reclaimed to the extent necessary to restore the flow pattern of shallow groundwater. Reclamation of this wall will be accomplished by creating a series of breaches, also known as finger drains, along the CBW. Each finger drain will consist of a 1.5 ft. wide by ~25 ft. long trench that is cut through the CBW at a right angle and to a depth that is ~2 ft. below the lowest historical ground water level. Gravel will be placed in the trench from the bottom to a point ~2 ft. above the highest recorded ground water level such that a highly permeable flow path is created through the CBW. The remaining trench will be backfilled with topsoil and seeded.

This method of CBW reclamation was selected as a means of effectively restoring the ground water flow system in the CPP area, while minimizing surface and environmental disturbance. The cost estimate for this phase of work is included in the worksheet MISC REC.

4. Wellfield Equipment Removal and Disposal

Decommissioning and reclamation of the wellfields will include removal of the module buildings and all pipes and utilities connecting the wells to the module buildings and the CPP, shredding or chipping the solid materials to reduce the volume, and disposing of these materials in an on-site landfill or licensed 11e.(2) waste site as appropriate, and reclaiming the surface as described for the other surface facilities. The estimated costs for each item of work in this task are included in the worksheet WF BLDGS PIPE.

5. Well Abandonment

All injection, recovery and monitor wells will be abandoned (plugged) with high solids bentonite in accordance with WDEQ LQD Rules and Regulations Chapter 8. After the well casing is cut off below grade a cement hole plug will be installed prior to backfill above the plug with soil. This work includes abandonment and reclamation of 118 monitor wells and 340 production and injection wells anticipated for use in uranium recovery in MU-1. It also includes an estimated 100 monitor wells in MU-2 and estimated 85 production and injection wells that will be installed in MU-2 but will not be operated (it is anticipated that MU-2 will be in development during the period). It also includes 59 existing baseline monitor wells. The deep disposal well that will be constructed during initial facilities construction will also be plugged and abandoned. For conservative purposes, in the case two deep disposal wells are installed during the period, an additional \$115,000 is included to plug and abandon that well (DDW-2). The estimated costs to abandon and reclaim all wells are included in worksheet WELL ABAN.

6. Radiological Surveys

During equipment decontamination, contamination surveys of building and equipment surfaces will be performed and analyzed. The results of these surveys will drive decontamination efforts. Following removal of all structures and regrading of the site to approximate original contours, and before topsoil is spread on the regraded area, a gamma survey and soil sampling will be conducted as described in Section 2 of the WDEQ Reclamation Plan (Section 6.4 of the NRC Technical Report). Soils will be cleaned up in accordance with the requirements of 10 CFR Part 40, Appendix A, including consideration of ALARA goals. The proposed limits and ALARA goals for cleanup of soils are summarized in the approved WDEQ Reclamation Plan and NRC Technical Report. Any areas which do not meet these limits will be remediated by removing contaminated soils and disposing at a licensed site. The site will then be regraded. This process will be repeated until all sites meet the ALARA goals for cleanup. The costs and areas subject to these surveys are provided in worksheets EQUIP, BLDGS, WF BLDGS PIPE and MISC REC.

7. Revegetation

At the completion of the previous tasks, and after topsoil has been spread across all regraded areas, all of the disturbed lands will be seeded with vegetation species that will return the lands to their pre-project conditions. The surface reclamation plan goals will be to return the land to equal or better condition than existed prior to uranium recovery, thus making it available for “unrestricted use.” The reclaimed land will be capable of supporting livestock grazing, dry land farming and wildlife habitat. Baseline soils, vegetation, and radiological data will be used to guide the reclamation activities. The costs and the areas to be revegetated are provided in worksheets WF REC and MISC REC and are based on actual costs for revegetation at the Ross site.

8. Miscellaneous Reclamation Activities

Costs for miscellaneous reclamation activities, some of which were discussed in the preceding sections, are provided in MISC REC. This includes:

Item

CPP/Office surface reclamation

Access road reclamation

Wastewater pipeline reclamation

Pond reclamation

Containment Barrier Wall (CBW) reclamation

Culver removal and disposal

Fence removal

Monitoring site removal and disposal

Radiologic surveys

Miscellaneous 11e.(2) soil transport and disposal



Attachment 2
Revised Annual Bond Estimate

Ross Uranium Project Surety Update January 2015

Total Restoration and Reclamation Cost Estimate

I.	GROUNDWATER RESTORATION COST	\$2,931,998
II.	EQUIPMENT REMOVAL & DISPOSAL COST	\$76,667
III.	BUILDING DEMOLITION AND DISPOSAL COST	\$386,374
IV.	WELLFIELD BUILDINGS, PIPE & EQUIPMENT REMOVAL & DISPOSAL COST	\$240,559
V.	WELL ABANDONMENT COST	\$662,265
VI.	WELLFIELD SURFACE RECLAMATION COST	\$42,390
VII.	TOTAL MISCELLANEOUS RECLAMATION COST	\$265,849
	SUBTOTAL RECLAMATION AND RESTORATION COST ESTIMATE	\$4,606,102
	CPI ESCALATOR- _____ to _____ (___%)	\$0
	SUBTOTAL	\$4,606,102
	ADMINISTRATIVE, OVERHEAD, AND CONTINGENCY ITEMS (25%)	\$1,151,525
	TOTAL	\$5,757,627
	TOTAL CALCULATED SURETY (IN 2014 DOLLARS)	\$5,757,600

Ross Uranium Project Surety Update January 2015

Ground Water Restoration	MU-1	MU-2
PV Assumptions		
Wellfield Area (ft2) (4 Mods injected, 1 Mod no inj)	1560044	390011
Wellfield Area (acres)	35.81	8.95
Affected Ore Zone Area (ft2)	1560044	390011
Avg. Completed Thickness	8	8
Porosity	0.34	0.34
Flare Factor (H=1.32, V=1.20, Overall= 1.58)	1.58	
Affected Volume (ft3)	19718956.16	0
Kgallons per Pore Volume	50149	0
Number of Wells in Unit(s)		
Production Wells		
Current	0	0
Estimated next report period	124	31
Total Estimated	124	31
Injection Wells		
Current	0	0
Estimated next report period	216	54
Total Estimated	216	54
Monitor Wells		
Current	31	0
Estimated next report period	87	100
Total Estimated	118	100
Restoration Wells		
Current		
Estimated next report period		
Total Estimated	0	0
Number of Wells per Wellfield	458	185
Total Number of Wells	643	185
Average Well Depth (ft)	500	500
I. Ground Water Sweep Costs (includes brine disposal)		
PV's Required	0.5	
Total Kgals for Treatment	25075	0
Ground Water Sweep Unit Cost (\$/Kgal)	\$0.67	\$0.00
Subtotal Ground Water Sweep Costs per Wellfield	\$16,885	\$0
Total Ground Water Sweep Costs	\$16,885	
II. Reverse Osmosis Costs (includes brine disposal)		
PV's Required	7	
Total Kgals for Treatment	351045	0
Reverse Osmosis Unit Cost (\$/Kgal)	\$0.81	\$0.00
Subtotal Reverse Osmosis Costs per Wellfield	\$283,258	\$0
Total Reverse Osmosis Costs	\$283,258	
III. Recirculation		
PV's Required	1	
Total Kgals for Treatment	50149	0
Recirculation Unit Cost (\$/Kgal)	\$0.39	\$0.00
Subtotal Recirculation Unit Costs per Wellfield	\$19,383	\$0
Total Recirculation Costs	\$19,383	

Ross Uranium Project Surety Update January 2015

Ground Water Restoration		MU-1	MU-2
IV. Monitoring and Sampling Costs			
A. Restoration Well Sampling			
Estimated Restoration Period (Years)		1	
1. Well Sampling prior to restoration start			
# of OZ BL Wells		46	
\$/sample		\$330	
2. Restoration Progress Sampling			
# of OZ BL Wells		46	
\$/sample		\$30	
Samples/Year		6	
3. UCL Sampling			
# of UCL Wells		72	
\$/sample		\$20	
Samples/Year		6	
Sub-total Restoration Analyses		\$32,100	
B. Short-term Stability			
Estimated Stabilization Period (Months)		12	
# of OZ BL Wells		46	
Samples/Year		368	
\$/sample		\$330	
# of UCL Wells		72	
Samples/Year		6	
\$/sample		\$30	
Sub-total Short-term Stability Analyses		\$134,400	\$0
Subtotal Monitoring and Sampling Costs per Wellfield		\$166,500	\$0
Total Monitoring and Sampling Costs		\$166,500	
V. Mechanical Integrity Test (MIT) Costs			
Five Year MIT Unit Cost (\$/well)	NA	NA	
Number of Wells (30% of Inj. and Rest. Wells)	NA	NA	
Subtotal Mechanical Integrity Testing Costs per Wellfield			
Total Mechanical Integrity Testing Cost			
TOTAL RESTORATION COSTS PER WELLFIELD		\$486,026	\$0
TOTAL WELLFIELD RESTORATION COST		\$486,026	
VI. Purchase/Install Additional High Eff. RO Unit (550 gpm)			
Cost for Additional High Eff RO Unit (includes installation)		\$750,000	
Total Cost for Additional High Eff RO Unit		\$750,000	
VII. Building Utility Costs			
	CPP	Office	
Electricity (\$/Month) estimate	\$2,500	\$300	
Propane (\$/Month)			
Natural Gas (\$/Month) estimate	\$2,000	\$500	
Number of Months	36	36	
Subtotal Utility Costs per Building	\$162,000	\$28,800	
Total Building Utility Costs	\$190,800		

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Ground Water Restoration	MU-1	MU-2
VIII. Vehicle Operation Costs		
Number of Pickup Trucks/Pulling Units (Gas)	6	
Unit Cost in \$/hr (WDEQ Guideline No.12, Table D-1)	\$28.52	
Average Operating Time (Hrs/Year)	200	
Total Number of Years (Average)	3	
Total Vehicle Operation Costs	\$102,672	
IX. Labor Costs		
Number of Environmental Managers/RSOs	1	
\$/Year	\$125,000	
Number of Years	3	
Number of Restoration Managers (during active restoration)	1	
\$/Year	\$75,000	
Number of Years	2	
Number of Environmental Technicians	1	
\$/Year	\$65,000	
Number of Years	3	
Number of Operators/Laborers (reduced during stabilization)	4	
\$/Year	\$65,000	
Number of Years	2	
Number of Maintenance Technicians (reduced during stabilization)	1	
\$/Year	\$65,000	
Number of Years	2.5	
Total Labor Costs	\$1,402,500	
TOTAL GROUND WATER RESTORATION COSTS	\$2,931,998	

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Equipment Removal Onsite Disposal and Loading

CPP

DDW Building

I. Removal and Loading Costs

A. Tankage

Number of Uncontaminated FG Tanks to be Cut Up	4
Volume of Uncontaminated Tank Construction Material (ft ³)	246

1. Labor for Dismantling

Number of Persons	3
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Ft ³ /Day	50
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Number of Days	5
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\$/Day/Person	\$200
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Subtotal Labor Costs	\$3,000
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2. Equipment

Number of Days	5
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\$/Day	\$500
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Subtotal Equipment Costs	\$2,500
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3. On site disposal cost per GL#12 (ft ³)	\$0.32
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On site disposal cost	\$79
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Subtotal Tankage Removal and Loading Costs	\$5,579
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Number of Contaminated FG Tanks to be Cut Up	4
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Volume of Contaminated Tank Construction Material (ft ³)	283
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1. Labor for Dismantling

Number of Persons	3
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Ft ³ /Day	50
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Number of Days	6
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\$/Day/Person	\$200
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Subtotal Labor Costs	\$3,600
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2. Equipment

Number of Days	6
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\$/Day	\$500
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Subtotal Equipment Costs	\$3,000
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Subtotal Tankage Removal and Loading Costs	\$6,600
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Equipment Removal Onsite Disposal and Loading		CPP	DDW Building
B.	Number of IX Columns to be Decontaminated, Cut Up and Disposed Onsite		
	Number of 11,000 gal IX Columns	8	
	Number of 5,500 gal Guard IX Columns	1	
	Volume of Decontaminated Tank Construction Material (ft ³)	12495	
1.	Labor for Decontamination and Dismantling		
	Number of Persons	3	
	Number of Days	18	
	\$/Day/Person	\$200	
	Subtotal Labor Costs	\$10,800	
2.	Equipment		
	Number of Days	18	
	\$/Day	\$500	
	Subtotal Equipment Costs	\$9,000	
3.	On site disposal cost per GL#12 (ft ³)	\$0.32	
	On site disposal cost	\$3,998	
	Subtotal Decontaminated IX Columns Removal and Onsite Disposal Costs	\$23,798	
C.	Contaminated PVC/HDPE Pipe		
	PVC/HDPE Pipe Footage	1000	30
	Average PVC Pipe Diameter (inches)	5	2
	Shredded PVC Pipe Volume Reduction (ft ³ /ft)	0.6	0.2
	Volume of Shredded PVC Pipe (ft ³)	600	6
1.	Labor for Shredding		
	Number of Persons	2	1
	Ft/Day	350	350
	Number of Days	3	1
	\$/Day/Person	\$200	\$200
	Subtotal Labor Costs	\$1,200	\$200
	Subtotal PVC Pipe Removal and Loading Costs	\$1,200	\$200
D.	Contaminated Pumps		
	Number of Contaminated Pumps	28	1
	Average Volume (ft ³ /pump)	4	6
	Volume of Pumps (ft ³)	112	6
1.	Labor		
	Number of Persons	3	2
	Pumps/Day	10	1
	Number of Days	3	1
	\$/Day/Person	\$200	\$200
	Subtotal Labor Costs	\$1,800	\$400
	Subtotal Pump Removal and Loading Costs	\$1,800	\$400

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Equipment Removal Onsite Disposal and Loading		CPP	DDW Building
E. Contaminated Dryer			
Dryer Volume (ft ³)		NA	
1. Labor			
Number of Persons		NA	
Ft ³ /Day		NA	
Number of Days		NA	
\$/Day/Person		NA	
Total Labor Cost		NA	
Total Dryer Dismantling and Loading Cost			\$0
F. Contaminated RO Units			
Number of RO Units			
Current			0
Planned (One RO installed with CPP, one installed later for restoration)			2
Average Volume (ft ³ /RO Unit)			1000
1. Labor			
Number of Persons			3
Number of Days			1
\$/Day/Person			\$200
Subtotal Labor Costs			\$1,200
Subtotal RO Unit Removal and Loading Costs			\$1,200
Total Equipment Removal and Loading Costs			\$40,177

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Equipment Removal Onsite Disposal and Loading		CPP	DDW Building
II. Transportation and Disposal Costs (NRC-Licensed Facility)			
A. Tankage			
Volume of Tank Construction Material (ft ³)		283	
Volume for Disposal Assuming 10% Void Space (ft ³)		311	
Transportation and Disposal Unit Cost (\$/ft ³)		\$12.85	
Subtotal Tankage Transportation and Disposal Costs		\$3,997	
B. PVC/HDPE Pipe			
Volume of Shredded PVC/HDPE Pipe (ft ³)		600	
Volume for Disposal Assuming 10% Void Space (ft ³)		660	
Transportation and Disposal Unit Cost (\$/ft ³)		\$12.85	
Subtotal PVC/HDPE Pipe Transportation and Disposal Costs		\$8,481	
C. Pumps			
Volume of Pumps (ft ³)		112	6
Volume for Disposal Assuming 10% Void Space (ft ³)		123	7
Transportation and Disposal Unit Cost (\$/ft ³)		\$12.85	\$12.85
Subtotal Pump Transportation and Disposal Costs		\$1,581	\$90
D. Dryer			
Dryer Volume (ft ³)	NA		
Volume for Disposal Assuming Dryer Remains Intact (ft ³)	NA		
Transportation and Disposal Unit Cost (\$/ft ³)		\$12.85	
Total Dryer Transportation and Disposal Costs	NA		
E. RO Units			
Volume of RO Units (ft ³)		1000	
Volume for Disposal Assuming 50% Volume Reduction (ft ³)		1000	
Transportation and Disposal Unit Cost (\$/ft ³)		\$12.85	
Subtotal RO Unit Transportation and Disposal Costs		\$12,851	
Subtotal Equipment Transportation and Disposal Costs per Facility		\$26,910	\$690
Total Equipment Transportation and Disposal Costs		\$27,600	\$690
III Health and Safety Costs			
Radiation Safety Equipment		\$8,000	200
Total Health and Safety Costs		\$8,000	\$200
SUBTOTAL EQUIPMENT REMOVAL AND DISPOSAL COSTS PER FACILITY		\$75,777	\$890
TOTAL EQUIPMENT REMOVAL AND DISPOSAL COSTS		\$76,667	

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Building Demolition and Disposal	CPP 140'x102'x30'	Office 115'x100'x17'	DDW Building 15'x15'x10'	Pot Water Building 15'x15'x10'
I. Decontamination Costs				
A. Wall Decontamination				
Area to be Decontaminated (ft ²)	3500	0	600	0
Application Rate (Gallons/ft ²)	1		1	
HCl Acid Wash, including labor (\$/Gallon)	\$0.50		\$0.50	
Subtotal Wall Decontamination Costs	\$1,750	\$0	\$300	\$0
B. Concrete Floor Decontamination				
Area to be Decontaminated (ft ²)	7200	0	225	0
Application Rate (Gallons/ft ²)	2		2	
HCl Acid Wash, including labor (\$/Gallon)	\$0.50		\$0.50	
Subtotal Concrete Floor Decontamination Costs	\$7,200	\$0	\$225	\$0
C. Deep Well Injection Costs				
Total Kgals for Injection	17.9	0	1.05	0
Deep Well Injection Unit Cost (\$/Kgals)	\$1.37	\$1.37	\$1.37	\$1.37
Subtotal Deep Well Injection Costs	\$25	\$0	\$1	\$0
Subtotal Decontamination Costs per Building	\$8,975	\$0	\$526	\$0
Total Decontamination Costs	\$9,501	0	0	0
II. Demolition Costs				
A. Building				
Assumptions:				
Limited contamination of CPP as there is no Precip/Dryer				
Volume of Building (ft ³)	428400	195500	2250	2250
Demolition Unit Cost per WDEQ Guideline No.12.App.K (\$/ft ³)	\$0.287	\$0.287	\$0.287	\$0.287
Subtotal Building Demolition Costs	\$122,951	\$56,109	\$646	\$646
B. Concrete Floor				
Area of Concrete Floor (ft ²)	14280	11500	225	225
Demolition Unit Cost per WDEQ Guideline No.12.App.K (\$/ft ²)	\$5.55	\$5.55	\$5.55	\$5.55
Subtotal Concrete Floor Demolition Costs	\$79,254	\$63,825	\$1,249	\$1,249
C. Concrete Footing				
Length of Concrete Footing (ft)	484	430	60	60
Demolition Unit Cost per WDEQ Guide. No.12.App.K (\$/lin. ft)	\$20.46	\$20.46	\$20.46	\$20.46
Subtotal Concrete Footing Demolition Costs	\$9,903	\$8,798	\$1,228	\$1,228
Subtotal Demolition Costs per Building	\$212,108	\$128,732	\$3,123	\$3,123
Total Demolition Costs	\$347,086			
III. Disposal Costs				
A. Building				
Volume of Building Materials (cy)	1587	724	83	83
1. On-Site				
Assumptions:				
Percentage (%)	100	100	100	100
Volume for Disposal (cubic yards)	1587	724	83	83
Disposal Unit Cost (\$/cy)	\$8.64	\$8.64	\$8.64	\$8.64
Subtotal On-Site Disposal Costs	\$13,709	\$6,256	\$720	\$720
2. NRC-Licensed Facility				
Percentage (%)	0	0	0	0
Volume for Disposal (ft ³)	0	0	0	0
Volume for Disposal Assuming 10% Void Space (ft ³)	0	0	0	0
Transportation and Disposal Unit Cost (\$/ft ³)	\$12.85	\$12.85	\$12.85	\$12.85
Subtotal NRC-Licensed Facility Disposal Costs	\$0	\$0	\$0	\$0
Subtotal Building Disposal Costs	\$13,709	\$6,256	\$720	\$720
B. Concrete Floor				
Area of Concrete Floor (ft ²)	14280	11500	225	225
Average Thickness of Concrete Floor (ft)	0.5	0.5	0.5	0.5
Volume of Concrete Floor (ft ³)	7140	5750	112.5	112.5
Volume of Concrete Floor (cy)	264	213	4	4
1. On-Site				
Percentage (%)	100	100	100	100
Volume for Disposal (cy)	264	213	4	4
Disposal Unit Cost per WDEQ Guideline No.12.App.K (\$/cy)	\$8.64	\$8.64	\$8.64	\$8.64
Subtotal On-Site Disposal Costs	\$2,285	\$1,840	\$36	\$36
2. NRC-Licensed Facility				
Assumptions:				
Percentage (%)	0	0	0	0
Volume for Disposal (ft ³)	0	0	0	0
Segregation and Loading Unit Cost (\$/ft ³)	\$0.00	\$0.00	\$0.00	\$0.00
Transportation and Disposal Unit Cost (\$/ft ³)	\$12.85	\$12.85	\$12.85	\$12.85
Subtotal NRC-Licensed Facility Disposal Costs	\$0	\$0	\$0	\$0
Subtotal Concrete Floor Disposal Costs	\$2,285	\$1,840	\$36	\$36
C. Concrete Footing				
Length of Concrete Footing (ft)	484	430	60	60
Average Depth of Concrete Footing (ft)	2	2	2	2
Average Width of Concrete Footing (ft)	3	3	3	3
Volume of Concrete Footing (ft ³)	2904	2580	360	360
Volume of Concrete Footing (cy)	108	96	13	13
Disposal Unit Cost per WDEQ Guideline No.12.App.K (\$/cy)	\$8.64	\$8.64	\$8.64	\$8.64
Subtotal Concrete Footing Disposal Costs	\$929	\$826	\$115	\$115
Subtotal Disposal Costs per Building	\$16,923	\$8,922	\$871	\$871
Total Disposal Costs	\$27,587			
III. Health and Safety Costs				
Radiation Safety Equipment	\$2,000		\$200	
Total Health and Safety Costs	\$2,000			
SUBTOTAL BUILDING DEMOLITION AND DISPOSAL COSTS	\$240,006	\$137,654	\$4,720	
TOTAL BUILDING DEMOLITION AND DISPOSAL COSTS	\$386,374			

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Wellfield Buildings and Equipment Removal and Disposal

MU-1

I. Wellfield Piping

Assumptions:

Number of Header Houses per Wellfield	4
Length of Piping per Header House (ft)	50600
Total Length of Piping (ft)	202400

A. Removal and Loading

Wellfield Piping Removal Unit Cost (\$/ft of pipe)	\$0.44
Subtotal Wellfield Piping Removal and Loading Costs	\$89,056

B. Transport and Disposal Costs (NRC-Licensed Facility)

Average Diameter of Piping (inches)	1.5
Chipped Volume Reduction (ft ³ /ft)	0.0069
Chipped Volume per Wellfield (ft ³)	1396.56
Volume for Disposal Assuming 10% Void Space (ft ³)	1536
Transportation and Disposal Unit Cost (\$/ft ³)	\$12.85

Subtotal Wellfield Piping Transport and Disposal Costs	\$19,739
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Wellfield Piping Costs per Wellfield	\$108,795
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Total Wellfield Piping Costs	\$108,795
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II. Well Pumps and Tubing

Assumptions:

Pump and tubing removal costs included under ground water restoration labor costs

100% of production/injection wells contain pumps and/or tubing

A. Pump and Tubing Transportation and Disposal

Number of Production Wells (operating wells only)	112
Number of Injection Wells (operating wells only)	196

1. Pump Volume

Number of Production Wells with Pumps	112
Average Pump Volume (ft ³)	2
Pump Volume per Wellfield (ft ³)	224

2. Tubing Volume

Assumptions:

Average tubing length/wellfield based on average well depth minus 25 ft

Number of Production Wells with Tubing	112
Number of Injection Wells with Tubing	196
Average Tubing Length per Well (ft)	475
Tubing Length per Wellfield (ft)	146300
Diameter of Production Well HDPE Tubing (inches)	1.5
Diameter of Injection Well HDPE Tubing (inches)	1.5
Chipped Volume Reduction (ft ³ /ft)	0.0069
Chipped Volume per Wellfield (ft ³)	1009

Volume of Pump and Tubing (ft ³)	1233
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Volume for Disposal Assuming 10% Void Space (ft ³)	1356
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Transportation and Disposal Unit Cost (\$/ft ³)	\$12.85
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Subtotal Pump and Tubing Transport and Disposal Costs	\$17,426
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Pump and Tubing Costs per Wellfield	\$17,426
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Total Pump and Tubing Costs	\$17,426
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Wellfield Buildings and Equipment Removal and Disposal	MU-1
III. Buried Trunk Line	
Length of Trunk line Trench (ft)	7938
A. Removal and Loading	
Main Pipeline Removal Unit Cost (\$/ft of trench)	\$3.33
Subtotal Trunk line Removal and Loading Costs	\$26,434
B. Transport and Disposal Costs (NRC-Licensed Facility)	
1. 3" HDPE Trunk line	
Piping Length (ft)	
Chipped Volume Reduction (ft ³ /ft)	0.022
Chipped Volume (ft ³)	0
2. 6" HDPE Trunk line	
Piping Length (ft)	3640
Chipped Volume Reduction (ft ³ /ft)	0.078
Chipped Volume (ft ³)	283.92
3. 10" HDPE Trunk line	
Piping Length (ft)	1900
Chipped Volume Reduction (ft ³ /ft)	0.277
Chipped Volume (ft ³)	526.3
4. 12" HDPE Trunk line	
Piping Length (ft)	
Chipped Volume Reduction (ft ³ /ft)	0.293
Chipped Volume (ft ³)	0
5. 14" HDPE Trunk line	
Piping Length (ft)	12236
Chipped Volume Reduction (ft ³ /ft)	0.359
Chipped Volume (ft ³)	4392.724
Total Trunk line Chipped Volume (ft ³)	5202.944
Volume for Disposal Assuming 10% Void Space (ft ³)	5723
Transportation and Disposal Unit Cost 11E2 (\$/ft ³)	\$12.85
Subtotal Trunk line Transport and Disposal Costs	\$73,545
Trunk line Decommissioning Costs per Wellfield	\$99,979
Total Trunk Line Decommissioning Costs	\$99,979
IV. Well Head Covers	
Total Quantity (operating wells)	308
Average Well Head Cover Volume (ft ³) (2'x2'x3')	12
A. Removal	
Total Volume (ft ³)	3696
Demolition Unit Cost per WDEQ Guideline No.12, App.K (\$/ft ³)	\$0.287
Subtotal Well Head Cover Demolition Costs	\$1,061
B. Survey and Decontamination	
Assumptions:	
Cost per Well Head Cover	
Subtotal Survey and Decontamination Costs	\$0
C. Disposal	
Total Volume (cy)	137
Volume for Disposal Assuming 10% Void Space (cy)	151
Disposal Unit Cost 11E2 (\$/cy)	\$12.85
Subtotal 11E2 Disposal Costs	\$1,940
Well Head Cover Removal and Disposal Costs per Wellfield	\$3,001
Total Well Head Cover Removal and Disposal Costs	\$3,001

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Wellfield Buildings and Equipment Removal and Disposal	MU-1
VI. Header Houses	
Total Quantity (operating)	4
Average Header House Volume (ft ³) (10'x36'x8')	2880
A. Removal	
Total Volume (ft ³)	11520
Demolition Unit Cost per WDEQ Guideline No.12,App.K (\$/ft ³)	\$0.287
Subtotal Building Demolition Costs	\$3,306
B. Survey and Decontamination	
Assumptions:	
Cost per Header House	\$1,000
Subtotal Survey and Decontamination Costs	\$4,000
C. Disposal	
Total Volume (cy)	427
Volume for Disposal Assuming 10% Void Space (cy)	469
On site Disposal Unit Cost per WDEQ Guideline No.12,App.K (\$/cy)	\$8.64
Subtotal On-Site Disposal Costs	\$4,052
Header House Removal and Disposal Costs per Wellfield	\$11,358
Total Header House Removal and Disposal Costs	\$11,358
 TOTAL REMOVAL AND DISPOSAL COSTS PER WELLFIELD	 \$240,559
TOTAL WELLFIELD BUILDINGS AND EQUIPMENT REMOVAL AND DISPOSAL COSTS	\$240,559

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Well Abandonment	MU-1	MU-2	Exisitng Baseline Wells
I. Well Abandonment (Wellfields)			
# of Production Wells (operating and/or installed)	124	31	0
# of Injection Wells (operating and/or installed)	216	54	0
# of Monitoring Wells (operating and/or installed)	118	100	59
#of Restoration Wells (operating and/or installed)	0	0	0
Total Number of Wells	458	185	59
Average Diameter of Casing (inches)	4.5	4.5	5
Average Depth (ft)	500	500	420
Well Abandonment Unit Cost (\$/well)	\$614	\$614	\$633
Subtotal Abandonment Cost per Wellfield	\$281,313	\$113,631	\$37,321
Total Wellfield Abandonment Costs	\$432,265		
		DDW-2 (If needed)	
II. Waste Disposal Well Abandonment	DDW- 1		
Estimated Well Abandonment Cost per Well	\$115,000	\$115,000	
Subtotal Waste Disposal Well Abandonment Costs per Well	\$115,000	\$115,000	
Total Waste Disposal Well Abandonment Costs	\$230,000		
TOTAL WELL ABANDONMENT COSTS	\$662,265		

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Wellfield and Satellite Surface Reclamation		MU-1	MU-2
I. Wellfield Pattern Area Reclamation			
Pattern Area (acres)		35.81	20
Disking/Seeding Unit Cost (\$/acre)		\$600	\$600
Subtotal Pattern Area Reclamation Costs per Wellfield		\$21,486	\$12,000
Total Wellfield Pattern Area Reclamation Costs		\$33,486	
II. Wellfield Road Reclamation			
A. Road Construction			
Length of Wellfield Roads (1000 ft)		7	
Wellfield Road Reclamation Unit Cost (\$/1000 ft)		\$1,272	\$1,272
Subtotal Road Reclamation Costs per Wellfield		\$8,904	\$0
Total Wellfield Road Reclamation Costs		\$8,904	
SUBTOTAL SURFACE RECLAMATION COSTS PER WELLFIELD		\$30,390	\$12,000
TOTAL WELLFIELD SURFACE RECLAMATION COSTS		\$42,390	

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Miscellaneous Reclamation

I. CPP/Office Area Reclamation

Assumptions

Concrete, asphalt, and building material used to backfill low areas

A. Ripping and Hauling Gravel

Assumptions

Average haul distance (ft) 500

Surface grade (%) 0%

Average Thickness of Gravel (ft) 0.33

Surface Area (acres) (minus building floor area) 4.1

Ripping Unit Cost per WDEQ Guideline No.12, App.1 (\$/acre) \$1.00

Volume of gravel (cy) 2183

Hauling Unit Cost per WDEQ Guideline No.12, App.C (\$/cy) \$0.50

Total Gravel Ripping and Hauling Cost \$1,096

B. Topsoil Application

1. Topsoil Replacement

Assumptions

Surface area (acres) 4.82

18 inches of topsoil removed and replaced at borrow area

Volume of topsoil (cy) 11664.4

Topsoil Removal/Replacement Unit Cost (\$/cy) \$1.00

Total Topsoil Removal/Replacement Cost \$11,664

C. Disking/Seeding

Assumptions

Surface Area (acres) 4.82

Disking/Seeding Unit Cost (\$/acre) \$600

Total Disking/Seeding Costs \$2,892

Total CPF/Office Area Reclamation \$15,652

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Miscellaneous Reclamation

	Main Access Road	Water Supply Well Road	DDW Road	MU-1 Road	MU-2 Road
II. Access Road Reclamation					
A. Assumptions					
Surface grade					
Length of road (miles)	0.45	0.085	0.246	1.90	0.40
Average road width (ft)	30	10	24	10	10
B. Ripping and Hauling Asphalt					
Assumptions					
Average haul distance (miles)					
Average Thickness of Asphalt (ft)					
Asphalt Surface Area (acres)					
Ripping Unit Cost per WDEQ Guideline No.12, App.I (\$/acre)					
Volume of Asphalt (cy)					
Hauling Unit Cost per WDEQ Guideline No.12, App.C (\$/cy)					
Subtotal Asphalt Ripping and Hauling Costs					
B. Gravel Road Base Removal					
Assumptions					
Average haul distance (ft)	500	500	500	500	500
Gravel Road Base Width (ft)	30	10	24	10	10
Gravel Road Base Area (acres)	1.6	0.1	0.7	2.3	0.5
Average Road Base Depth (ft)	0.33	0.33	0.33	0.33	0.33
Volume of Road Base (cy)	871	55	381	1226	258
Removal Unit Cost per WDEQ Guideline No.12, App.C (\$/cy)	\$1.10	\$1.10	\$1.10	\$1.10	\$1.10
Subtotal Gravel Road Base Removal Costs	\$958	\$60	\$419	\$1,349	\$284
C. Ripping Overburden with Dozer					
Assumptions					
Overburden Surface Area (acres)	1.6	0.1	0.7	2.3	0.5
Ripping Unit Cost per WDEQ Guideline No.12, App.II (\$/acre)	\$1,205.00	\$1,205.00	\$1,205.00	\$1,205.00	\$1,205.00
Subtotal Ripping Overburden Costs	\$1,972	\$124	\$862	\$2,775	\$584
D. Topsoil Application					
Assumptions					
Average haul distance (ft)	500	500	500	500	500
Topsoil Surface Area (ft ²) (Road surface width x 1.1)	78408	4937	34290	110352	23232
Depth of Topsoil (ft)	1.5	1.5	1.5	1.5	1.5
Volume of Topsoil (cy)	4356	274	1905	6131	1291
Topsoil Unit Cost per WDEQ Guideline No.12, App.C (\$/cy)	\$1.00	\$1.00	\$1.00	\$1.00	\$1.00
Subtotal Topsoil Application Costs	\$4,356	\$274	\$1,905	\$6,131	\$1,291
E. Disking/Seeding					
Assumptions					
Surface Area (acres)	1.6	0.1	0.7	2.3	0.5
Disking/Seeding Unit Cost (\$/acre)	\$600	\$600	\$600	\$600	\$600
Subtotal Disking/Seeding Costs	\$982	\$62	\$429	\$1,382	\$291
Subtotal Reclamation Costs per Access Road	\$8,268	\$520	\$3,615	\$11,637	\$2,450
Total Access Road Reclamation Costs	\$26,490				

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Miscellaneous Reclamation

III. Wastewater Pipeline Reclamation

DDW-1 Pipeline

A. Pipeline Removal and Loading	
Length of HDPE Pipe Trench (ft)	1600
Main Pipeline Removal Unit Cost (\$/ft of trench)	\$3.33
Subtotal Pipeline Removal Costs	\$5,328
B. Pipeline Transportation and Disposal (NRC-Licensed Facility)	
Pipe Diameter (inches)	2
Chipped Volume Reduction (ft ³ /ft)	0.014
Subtotal Volume of Shredded PVC Pipe (ft ³)	24.64
Transportation and Disposal Unit Cost (\$/ft ³)	\$12.85
Subtotal Pipeline Disposal Costs	\$317
C. Disking/Seeding	
Assumptions:	
Width of Pipeline Trench (ft)	2
Area of Pipeline Trench (acres)	0.1
Disking/Seeding Unit Cost (\$/acre)	\$600
Subtotal Disking/Seeding Costs	\$44
Subtotal Reclamation Costs per Pipeline	\$5,689
Total Wastewater Pipeline Reclamation Costs	\$5,689

IV. Pond Reclamation (Pond 1, comprised of 3 cells)

WW Storage Pond 1 (3 cells) Sediment Pond

A. HDPE Liner Removal and Disposal		
Assumptions:		
HDPE Primary liner for Pond 1 constitutes 11E2 waste		
Thickness of HDPE Primary liner (mil)	60	60
HDPE Secondary liner for Pond 1 and Sediment pond not contaminated		
Thickness of HDPE Secondary liner (mil)	40	
Liner swell factor (50%)	1.5	1.5
Width of Pond (ft)	240	130
Length of Pond (ft)	545	130
Depth of Pond (ft)	15	15
Surface area of pond (ft ²)	130800	16900
Surface area of liner (ft ²)	143616	6600
Volume of HDPE Liner (cy)	0	40
1. Removal and Loading		
Removal and Loading Unit Cost based on engineer's estimate	\$30,000.00	\$1,000.00
Sub Total Liner Removal and Loading Costs	\$31,000	
2. Transportation and Disposal 11E2		
Volume of HDPE Primary Liner (ft ³)	1077	
Transportation and Disposal Unit Cost 11E2 (\$/ft ³)	\$12.85	
Sub Total Liner Transportation and Disposal Costs 11E2	\$1,077	
3. Transportation and Disposal Not Contaminated		
Volume of HDPE Secondary Liner (ft ³)	718	33
On site Disposal Unit Cost (\$8.64/yd ³)	\$230	\$11
Subtotal Liner Transportation and Disposal Costs	\$240	\$0
Sub Total Liner Transportation and Disposal Costs	\$240	
B. Removal and disposal pond leak detection system		
Labor/equipment estimate	\$5,000	
Volume of material estimate (ft ³)	500	
Transportation and Disposal Unit Cost 11E2 (\$/ft ³)	\$12.85	
Sub Total Leak Detection Removal and Disposal Costs	\$11,425	

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Miscellaneous Reclamation

C. Backfill Pond (Topsoil covered in CPP/Office Reclamation)

Assumptions per cell (3):

Average backfill length to fill (ft)	250	110
Average backfill width to fill (ft)	170	110
Average depth to grade minus topsoil (ft)	8.5	8.5
Average push distance with dozer (ft)	50	50
Surface grade (%)	0%	0%

Volume of backfill Topsoil (cy) for 3 cells

40,139 448

Backfill Unit Cost per WDEQ Guideline No.12., App E (\$/cy)

\$0.16 \$0.32

Subtotal Backfill Costs

\$19,266 \$429

Subtotal Backfill Costs

\$19,695

D. Soil Sampling and Analysis Costs

Number of samples

12

Cost per sample (\$)

\$150

Subtotal Soil Sampling Costs (\$)

\$1,800

Subtotal Pond Reclamation Costs (minus topsoil)

\$64,161

Total Pond Reclamation Costs (minus topsoil)

\$127,599

V. Containment Barrier Wall (CBW) Reclamation

Assumptions

Labor/equip to excavate/install finger drains (estimate)

\$7,650

Gravel for finger drains (estimate)

\$2,000

Total Containment Barrier Wall (CBW) Reclamation Costs

\$9,650

VI. Culvert Removal and Disposal

Assumptions

Number

10

Removal Unit Cost per WDEQ Guideline No.12., App J (each)

\$139.10

Transport and on-site disposal cost (estimated for each)

\$100.00

Total Culvert Removal and Disposal

\$2,391

VII Fence Removal and Disposal

Assumptions

Length 4-Strand Barbwire Fence (MU-1 50 acres)

6000

Unit Cost per WDEQ Guideline No.12., App H (\$/ft)

\$0.39

Length CPP Fence

8500

Unit Cost per WDEQ Guideline No.12., App H (\$/ft)

\$0.39

Total Fence Removal and Disposal Costs

\$5,655

VII Monitoring Site Removal and Disposal

Assumptions

3 Surface Water Sites (estimated at \$2400 each)

\$7,200

7 Air Mon Sites (estimated at \$500 each)

\$3,500

1 Met Station (estimated at \$2500 each)

\$2,500

Total Monitoring Site Removal and Disposal Costs

\$13,200

IX. Radiologic Surveys

Assumptions

Misc meter/smear surveys buildings/equipment (100 at \$55 each)

\$5,500

Decomm area gamma surveys (est based on baseline survey costs)

\$15,000

Misc soil samples (Ra-226/U)

\$13,000

Total Radiologic Surveys Costs

\$33,500

X. Misc Soil 11E2 Soil Transport/Disposal

Soil from Mod Buildings (assume 50 yd3)

Soil from spills (assume 25 yds3)

11E2 soil transport and disposal volume (yd3)

75

11E2 soil transport and disposal cost (\$/ft3)

\$12.85

Total Soil 11E2 Soil Transport/Disposal

\$26,022.75

TOTAL MISCELLANEOUS RECLAMATION COSTS

\$265,849

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GROUNDWATER SWEEP (GWS)

Assumptions:

1. All pumps are 5 hp pumping at 20 gpm
2. Cost of electricity = \$0.06/kwh
3. All wastewater brine pumped to DDW for injection at \$1.37/1000 gallons.
with 90% permeate/10% brine split
4. Repair and maintenance costs estimated at \$0.10/1000 gallons
5. Process sampling and analysis costs estimated at \$0.25/1000 gallons at 200 GPM flow rate
6. Labor costs are covered in GW REST

Wellfield Pumping Costs per 1000 Gallons

$$\frac{1000 \text{ gal}}{1} \times \frac{5 \text{ hp}}{20 \text{ gpm}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{0.746 \text{ kwh}}{\text{hp}} \times \frac{\$ 0.06}{\text{kwh}} = \$ 0.1865$$

Repair and Maintenance Costs per 1000 Gallons = \$ \$0.10

Process Sampling and Analysis Costs per 1000 Gallons = \$ \$0.25

RO Wastewater Brine to DDW per 1000 Gallons = \$ \$0.14

Note: only 10% of RO Volume Requires DDW Disposal

TOTAL GWS COSTS PER 1000 GALLONS = \$ 0.67

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REVERSE OSMOSIS (RO)

Assumptions:

- 1 Cost of electricity = \$0.06/kwh
- 2 90% permeate/10% brine split
- 3 Membrane life of 4 years.
- 4 Includes cost of pumping from wellfield to RO Unit
- 5 The 10% reject is disposed at the DDW at a cost of \$1.37/1000 gallons
- 6 Process sampling and analysis costs estimated at \$0.17/1000 gallons at 700 GPM flow rate
- 7 Labor costs are covered in GW REST

Reverse Osmosis Costs per 1000 Gallons

Electricity	= \$ 0.15
Chemicals	= \$ 0.10
Membrane Replacement	= \$ 0.00
Repair and Maintenance	= \$ 0.10
Pumping from Wellfield	= \$ 0.15
Process Sampling and Analysis	= \$ 0.17

RO Wastewater Brine to DDW per 1000 Gallons = \$ 0.14

Note: only 10% of RO Volume Requires DDW Disposal

TOTAL RO COSTS PER 1000 GALLONS = \$ 0.81

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RECIRCULATION (REC)

Assumptions:

1. All pumps are 5 hp pumping at 20 gpm
2. Cost of electricity = \$0.06/kwh
- 4 Repair and maintenance costs estimated at \$0.10/1000 gallons
- 5 Process sampling and analysis costs estimated at \$0.10/1000 gallons
- 6 Labor costs are covered in GW REST

Wellfield Pumping Costs per 1000 Gallons

$$\frac{1000 \text{ gal}}{1} \times \frac{5 \text{ hp}}{20 \text{ gpm}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{0.746 \text{ kwh}}{\text{hp}} \times \frac{\$ 0.06}{\text{kwh}} = \$ 0.1865$$

Repair and Maintenance Costs per 1000 Gallons = \$ 0.10

Process Sampling and Analysis Costs per 1000 Gallons = \$ 0.10

TOTAL GWS COSTS PER 1000 GALLONS = \$ 0.39

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DEEP WELL INJECTION

Assumptions:

1. Pump 75 hp pumping at 50 gpm
2. Cost of electricity = \$0.06/kwh
- 3 Repair and maintenance costs estimated at \$0.10/1000 gallons
- 4 Labor costs are covered in GW REST

Waste Disposal Pumping Costs per 1000 Gallons

$$\frac{1000 \text{ gal}}{1} \times \frac{75 \text{ hp}}{50 \text{ gpm}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{0.746 \text{ kwh}}{\text{hp}} \times \frac{\$ 0.06}{\text{kwh}} = \$ 1.12$$

Repair and Maintenance Costs per 1000 Gallons = \$ 0.10

Chemical Costs per 1000 Gallons = \$ 0.15

Scale Inhibitor	= \$	0.10
Corrosion Inhibitor	= \$	0.05

TOTAL DEEP WELL INJECTION COSTS PER 1000 GALLONS = \$ 1.37

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WELL ABANDONMENT

Materials	500 ft Well/4.5 Inch Casing (4.36 inch ID)	420 ft Well/5.0 Inch Casing (4.91 inch ID)	Comments
Volume of high solids bentonite required	51.8	56.7	Calculated
Bentonite Sacks Required per Well	16	18	Based on actual quantities used during exploration drill hole plugging
Bentonite Sack Cost	\$9.17	\$9.17	Based on actual prices during exploration drill hole plugging
Bentonite Cost per Well	\$146.72	\$165.06	Calculated
Cement hole plug	\$5.00	\$5.00	Estimate
Total Materials Cost Per Well	\$151.72	\$170.06	
Equipment Rental			
Hours required per well	2.5	2.5	Based on actual quantities used during exploration drill hole plugging
Backhoe cost per hour	\$85.00	\$85.00	Based on actual prices during exploration drill hole plugging
Cementer cost per hole	\$250.00	\$250.00	Based on actual prices during exploration drill hole plugging
Total Equipment Cost Per Well	\$462.50	\$462.50	
Total Cost to Plug & Abandon Recovery, Injection & Monitor Wells (500 ft)	\$614.22	\$632.56	

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FIVE YEAR MECHANICAL INTEGRITY TESTS (MIT)

Assumptions:

1. Based on actual operating costs
2. Use Pulling Unit for ___ hr/well at cost of \$___/hr.
3. Use MIT Unit for ___ hr/well at cost of \$___/hr.
4. Labor for operation of pulling unit will require ___ workers at \$___/hr
5. Labor for operation of MIT Unit will require ___ worker at \$___/hr

MIT Costs per Well

Equipment:

Pulling Unit					
hours	X	\$	per hour		=\$ 0.00
MIT Unit					
hours	X	\$	per hour		=\$ 0.00

Labor:

Pulling Unit					
hours	X	\$	per hour	X workers	=\$ \$0.00
MIT Unit					
hours	X	\$	per hour		=\$ 0.00

MIT COST PER WELL =\$ 0

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MAIN PIPELINE REMOVAL

Assumptions:

1. Trenching with track hoe at 400 ft/day
2. Pipeline extraction and backfilling with track hoe at 300 ft/day
3. Trackhoe rental: \$1280/week
4. Fuel cost: \$18.00/operating hour
5. Trackhoe operation requires 1 worker at \$25/hour
6. Pipeline extraction requires 2 workers at \$25/hour (in addition to trackhoe operator)
7. Pipelines removed simultaneously
8. Includes removal of manholes
9. Operating schedule: 8 hrs/day, 5 days/week

Main Pipeline Removal Costs per ft of Trench

Equipment

Trackhoe

$$\frac{\$ 1280}{\text{week}} \times \frac{1 \text{ week}}{5 \text{ days}} \times \frac{1 \text{ days}}{300 \text{ ft}} = \$ 0.85$$

Fuel

$$\frac{\$ 18}{\text{hour}} \times \frac{8 \text{ hrs}}{1 \text{ day}} \times \frac{1 \text{ days}}{300 \text{ ft}} = \$ 0.48$$

Labor

Track hoe Operation

$$\frac{\$ 25}{\text{man hr}} \times \frac{8 \text{ man hrs}}{1 \text{ day}} \times \frac{1 \text{ days}}{300 \text{ ft}} = \$ 0.67$$

Pipeline Extraction

$$\frac{\$ 25}{\text{man hr}} \times \frac{16 \text{ man hrs}}{1 \text{ day}} \times \frac{1 \text{ day}}{300 \text{ ft}} = \$ 1.33$$

MAIN PIPELINE REMOVAL COST PER FT OF TRENCH = \$ 3.33

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WELLFIELD PIPING REMOVAL

Assumptions:

1. Trenching with backhoe at 2000 ft/day
2. Pipeline extraction and backfilling with backhoe at 2000 ft/day
3. Backhoe rental: \$800/week
4. Fuel cost: \$12.40/operating hour
5. Backhoe operation requires 1 worker at \$25/hour
6. Pipeline extraction requires 1 workers at \$25/hour (in addition to backhoe operator)
7. Operating schedule: 8 hrs/day, 5 days/week

Wellfield Pipe Removal Costs per ft of Pipe

Equipment

Backhoe

$$\frac{\$ 800}{\text{week}} \times \frac{1 \text{ week}}{5 \text{ days}} \times \frac{1 \text{ days}}{1500 \text{ ft}} = \$ 0.11$$

Fuel

$$\frac{\$ 13.00}{\text{hour}} \times \frac{8 \text{ hrs}}{1 \text{ day}} \times \frac{1 \text{ days}}{1500 \text{ ft}} = \$ 0.07$$

Labor

Backhoe Operation

$$\frac{\$ 25}{\text{man hr}} \times \frac{8 \text{ man hrs}}{1 \text{ day}} \times \frac{1 \text{ days}}{1500 \text{ ft}} = \$ 0.13$$

Pipeline Extraction

$$\frac{\$ 25}{\text{man hr}} \times \frac{8 \text{ man hrs}}{1 \text{ day}} \times \frac{1 \text{ day}}{1500 \text{ ft}} = \$ 0.13$$

WELLFIELD PIPE REMOVAL COST PER FT OF PIPE = \$ 0.44

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WELLFIELD ROAD RECLAMATION

Assumptions

1. Gravel road base removed at cost of \$111/cy/1000 ft (WDEQ Guideline No. 12, App. C, Level Ground, 500 ft haul)
2. Gravel road base: average depth = 0.3 ft, average width = 10 ft
3. Roads scarified prior to topsoil application at cost of \$68.69/acre (WDEQ Guideline No. 12, Appendix P)
4. Grading of scarified roads prior to topsoil application at cost of \$74.90/acre (WDEQ Guideline No. 12, Appendix G)
5. Topsoil applied at cost of \$1.00/cy/1000 ft (WDEQ Guideline No. 12, App. C, Level Ground, 500 ft haul)
6. Stripped topsoil: average depth = 1.5 ft, average width = 16 ft
7. Disking/seeding cost of \$600 acre is based on estimated contractor costs in UC-Disk Worksheet

Gravel Road Base Removal Costs per 1000 ft of Road

$$\frac{1000 \text{ ft}}{1} \times \frac{0.30 \text{ ft}}{1} \times \frac{10 \text{ ft}}{1} \times \frac{1 \text{ cy}}{27 \text{ ft}^3} \times \frac{\$1.00}{\text{cy}} = \$ 111$$

Scarification Costs per 1000 ft of Road

$$\frac{1000 \text{ ft}}{1} \times \frac{16 \text{ ft}}{1} \times \frac{1 \text{ acre}}{4.356 \times 10^4 \text{ ft}^2} \times \frac{\$68.69}{\text{acre}} = \$ 25$$

Grading Costs per 1000 ft of Road

$$\frac{1000 \text{ ft}}{1} \times \frac{16 \text{ ft}}{1} \times \frac{1 \text{ acre}}{4.356 \times 10^4 \text{ ft}^2} \times \frac{\$74.00}{\text{acre}} = \$ 27$$

Topsoil Application Costs per 1000 ft of Road

$$\frac{1000 \text{ ft}}{1} \times \frac{1.50 \text{ ft}}{1} \times \frac{16 \text{ ft}}{1} \times \frac{1 \text{ cy}}{27 \text{ ft}^3} \times \frac{\$1.00}{\text{cy}} = \$ 889$$

Disking/Seeding Costs per 1000 ft of Road

$$\frac{1000 \text{ ft}}{1} \times \frac{16 \text{ ft}}{1} \times \frac{1 \text{ acre}}{4.356 \times 10^4 \text{ ft}^2} \times \frac{\$600}{\text{acre}} = \$ 220$$

TOTAL WELLFIELD ROAD RECLAMATION COSTS PER 1000 FT OF ROAD

$$= \$ 1,272$$

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11E2 BY PRODUCT CONTAMINATED WASTE TRANSPORT AND DISPOSAL

Assumptions:

1. 30 yd³ per load
2. 470 miles to Shirley Basin 11E2 disposal facility (round trip)
3. Transportation at \$3.00 per mile
4. Disposal fee at \$300/yd³ (\$11.11/ft³)

11E2 By Product Waste Transport

$$\frac{470 \text{ miles}}{1 \text{ mile}} \times \frac{\$3.00}{1 \text{ mile}} = \$1,410.00 \text{ 30 yd}^3$$

11E2 By Product Waste Disposal Cost

\$11.11 ft³

Total 11E2 BY PRODUCT CONTAMINATED WASTE TRANSPORT AND DISPOSAL

\$12.85 ft³

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DISKING/SEEDING

Assumptions:

1. Based on estimated contractor costs

TOTAL SEEDING/MULCHING COSTS PER ACR = \$ 600

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Abbreviations/Acronyms

\$	Dollars
\$/Kgal	Dollars per 1000 gallons
avg	average
ft	feet
ft ²	square feet
ft ³	cubic feet
gal	gallon
gpm	gallons per minute
H&S	Health and Safety
H ₂ S	Hydrogen Sulfide
H ₂ SO ₄	Sulfuric Acid
HCl	Hydrochloric Acid
Hp	Horsepower
Kgal	1000 gallons
Kwh	Kilowatt-hours
NaOH	Caustic Soda
OD	Outside Diameter
PPE	personal protective equipment
PV	Pore Volume Estimate
reqm't	requirement
RO	Reverse Osmosis
WDW	Waste Disposal Well
yd ³	cubic yards
yr	year